THE WINTER FEEDING OF BEEF CATTLE IN ONTARIO

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Winter fed steers in April, showing sheds, yards, feed racks and mangers, at the Central Experimental Farm, Ottawa, Ont.

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RESULTS OF EXPERIMENTS AND EXPERIENCE ON THE CENTRAL EXPERIMENTAL FARM, OTTAWA

By

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INTRODUCTION

Winter finishing of beef cattle in Ontario, particularly in the western part of the province, has been and still is one of the main winter activities on many farms. In later years the practice has not been followed to quite the same extent, due to the competition set up by the cheaply raised and fattened western beef as well as to the inroads made by dairy farming, in what were formerly beef raising sections.

A close study of the beef cattle feeding and market situation in Canada and particularly in the province of Ontario, reveals a few facts of economic importance to the beef cattle industry which we as live stock farmers, cannot afford to overlook. While we have a fairly good market both at home and abroad, we cannot afford to have any weak spots in the organization which supplies these markets. Competition from countries, favourably located, is keen and active. Some of what might be termed the weak spots in the organization are as follows:

First.—That a relatively small percentage of animals is marketed between December and April inclusive. (See Chart 4.)

Second.—That finished animals always demand a premium and particularly during the above mentioned months. (See Chart 4.)

Third.—That owing to poor breeding, poor raising, or lack of finish, possibly a combination of all three, a large percentage of steers marketed do not make the grade that holds the trade and commands the top price. (See Chart 4.)

Fourth.—That the Canadian public discriminates against frozen beef, which means that were the markets kept supplied with fresh beef more regularly better prices would obtain.

Fifth.—That a relatively small percentage of steers which are at present classed as export steers, are sufficiently well finished for the trade. Hence proper winter finishing of such steers would seem advisable and profitable.

Sixth.—That we have not made sufficient use of the beef bullock as a medium for the utilization of rough feeds that can be grown cheaply but are costly to market and if marketed in their raw state leave the soil depleted of plant food.

It is the purpose of this bulletin to bring home to its readers, in as brief space as possible, the truth of these statements as well as many others and to show the possibilities of winter feeding of beef cattle.

RELATIVE RECEIPTS AND AVERAGE PRICES OF FINISHED STEERS MARKETED IN ONTARIO

The following four charts prepared by Mr. P. E. Light, of the Live Stock Branch, Department of Agriculture, Ottawa, are included in an endeavour to show the trend of the market as regards relative receipts and prices of the more important classes of steers during the last four years. Chart 1 gives this information for the 700-1,000 pounds steers. Chart 2 gives this information for the 1,000-1,200 pounds steers. Chart 3 gives this information for steers over 1,200 pounds. Chart 4 is a four-year average of the information given by years on the previous charts and constitutes, in reality, an analysis of these charts.

Space will not permit of separate and specific analysis of charts 1 to 3, but by any one sufficiently interested to study them, much useful information will be found. One fact that is particularly noticeable from a glance at charts 1 and 2 is that the lines indicating prices and receipts are very erratic, indicating that the market for these classes is not steady. This unsteadiness is not noticeable to the same extent in chart 3, showing that for this class there is a more stable market. A study of chart 4 shows that the peak of receipts is invariably reached around August or September, while it is comparatively low from then on through the early winter months. There is an exception to this in the case of the 700-1,000 pounds steers, which reached their peak in March. A reference to the yearly chart for this class will show that this exception held good for the years 1920 and 1921, and to a certain extent for 1919, but that the years 1918 and 1922 show a downward trend. As these years can be considered more normal market years than the former, the exception helps to prove the rule. It will also be noticed, in this connection, that there is a fairly rapid and consistent rise in price for all classes through March, April, and May, when the winter-finished steer is usually ready to turn off. Further, chart 4 shows that the finished animal, both as to maturity and fleshing, has commanded the highest price throughout this period of years. Presumably there was a considerable number of highly finished baby beeves in the 700-1,000 pounds class, which animals would command a high price. Apparently they were submerged by the larger number of steers thus classified through lack of weight, due to their unfinished condition, which in turn lowered the average price for this class.

Possibly the most outstanding feature indicated in this chart is the relationship of the numbers of finished and unfinished steers. For instance, the highest monthly receipt of steers of 1,200 pounds and over was 1,500 head; of those weighing 1,000 to 1,200 pounds, 3,700 head; while in the 700 to 1,000 pounds class there were 6,900.

THE PROPER TYPE OF STEER TO FEED

One of the most important requisites in the successful finishing of beef cattle is the proper type of steer to start with. Some feeders raise and finish their own steers; others may raise a few head, supplementing these by purchasing from neighbouring farmers who do not make a practice of finishing their own steers, while still others concentrate their efforts on finishing steers, purchasing their stockers locally or on the larger markets.

The farmer, who raises his own feeders, can safeguard type and quality in his animals by good feeding practice and the use of a high class bull. The man who buys his feeders must show even more care, in that he must secure evidence of beef breeding, and a fair degree of beef type. Most important of all, he must "buy them right". A cent or a fraction thereof, per pound, in the purchase price of the animals, may mean the difference between profit and loss for the feeder.

The "cheap" or "common" feeder (in the sense of his being an inferior one in breeding and type) is nearly always a loser for his owner in the end. Such steers have not the ability to make economical use of the feed consumed. Such feeders must be

CHART 1.—Relative Receipts and Average Prices of Finished Steers Weighing (700-1,000 pounds), Marketed in Ontario for Years Mentioned.

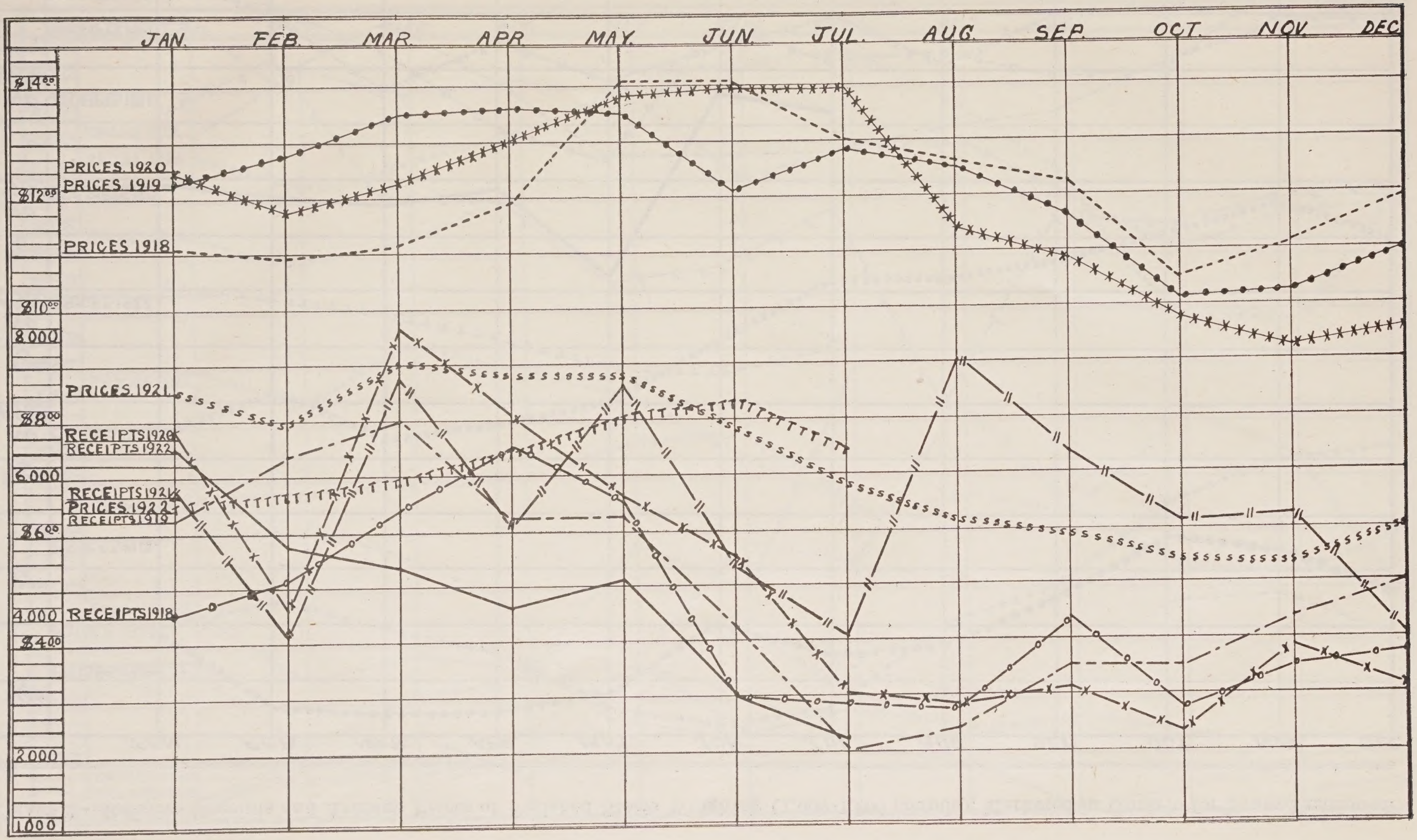


CHART 2.—Relative Receipts and Average Prices of Finished Steers Weighing (1,000-1,200 pounds), Marketed in Ontario for Years Mentioned.

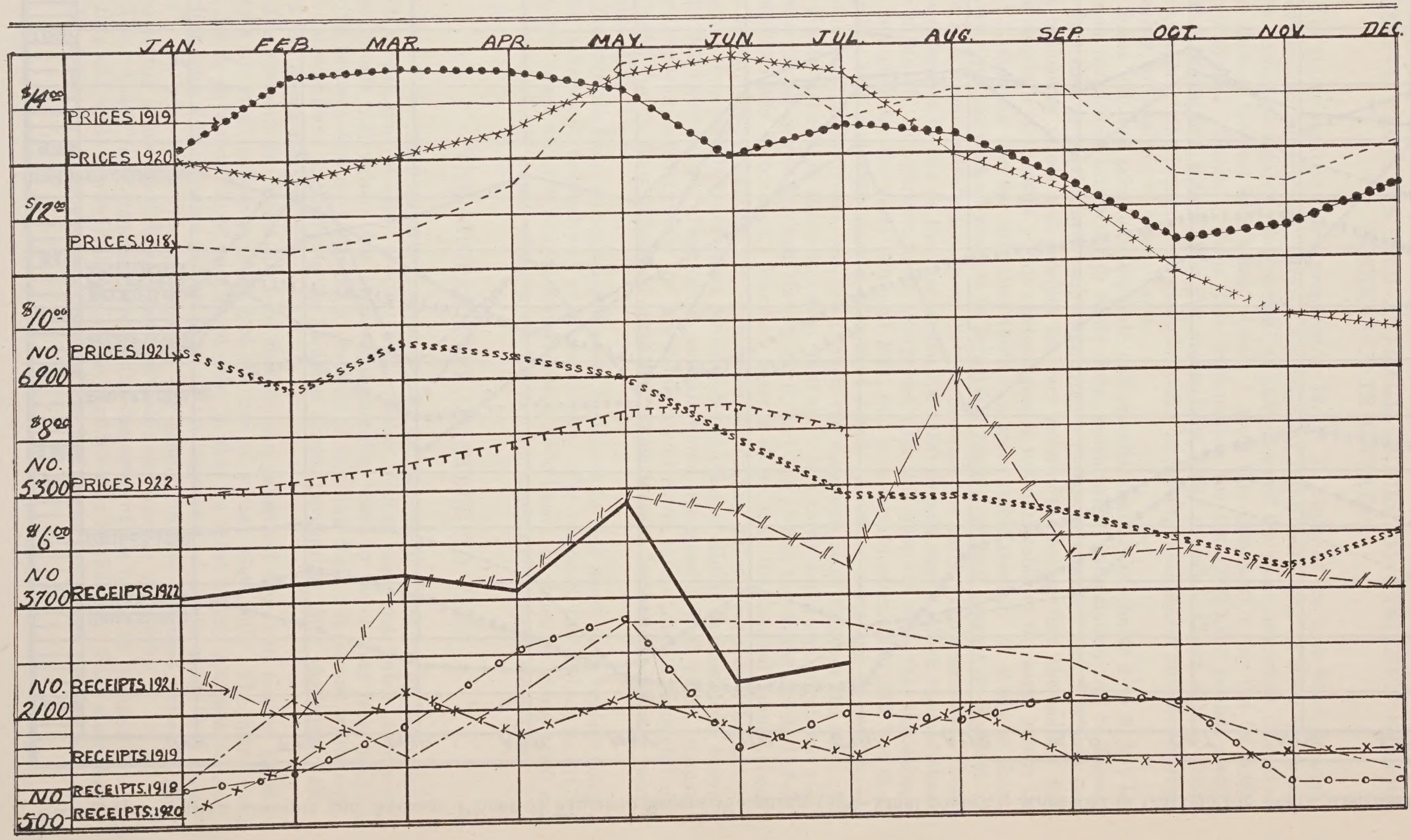


CHART 3.—Relative Receipts and Average Prices of Heavy Steers Weighing (1,200 pounds and up), Marketed in Ontario For Years Mentioned.

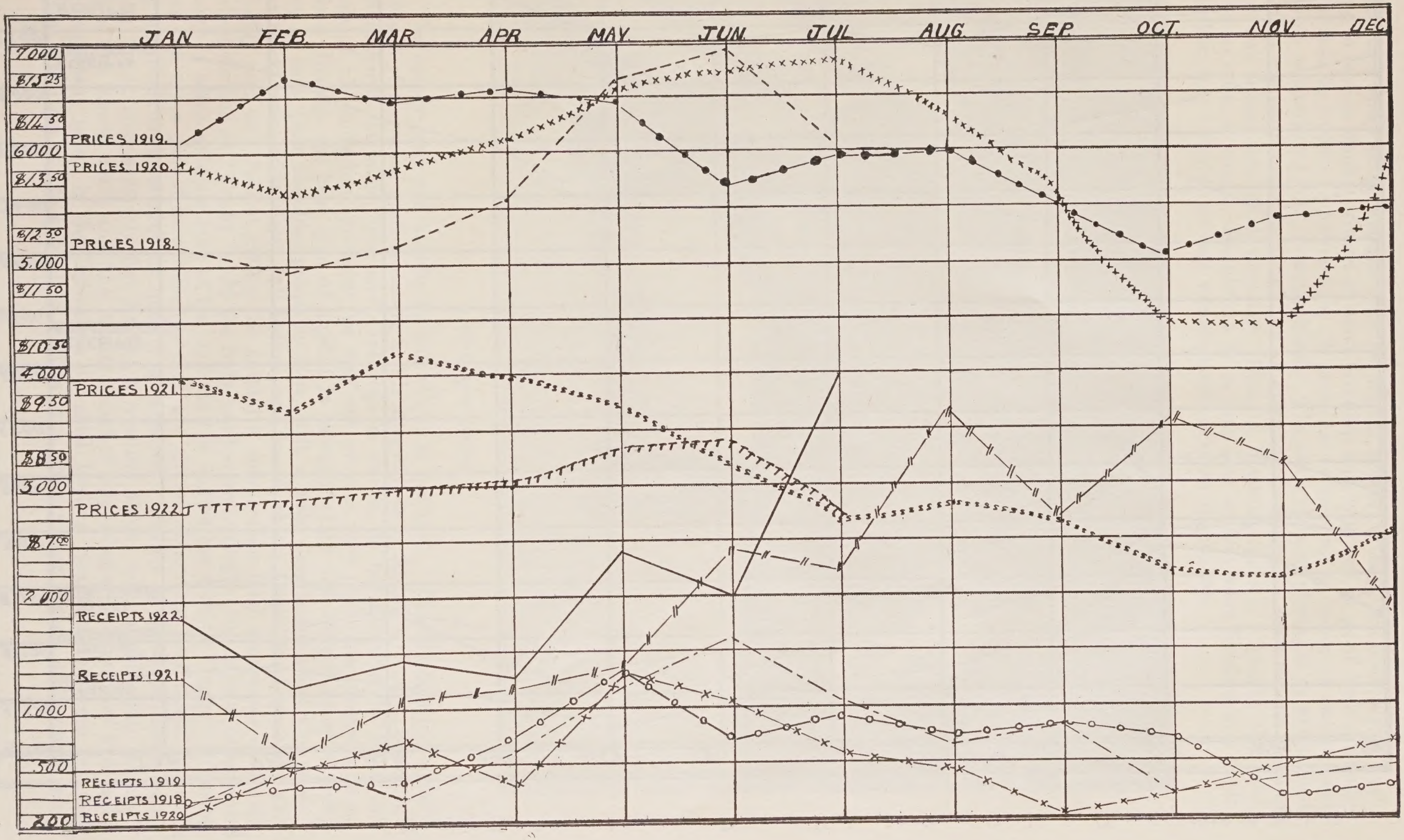
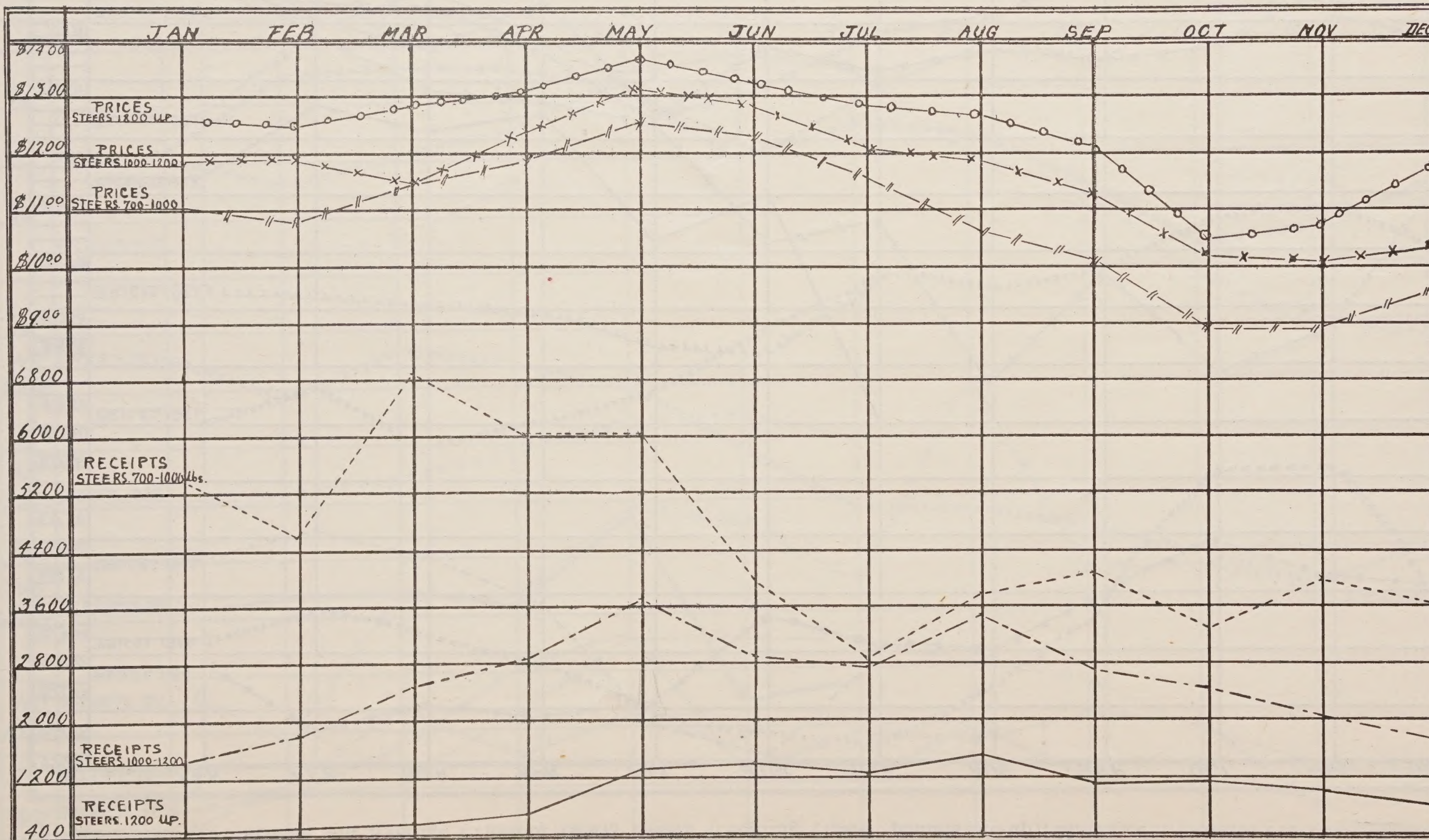
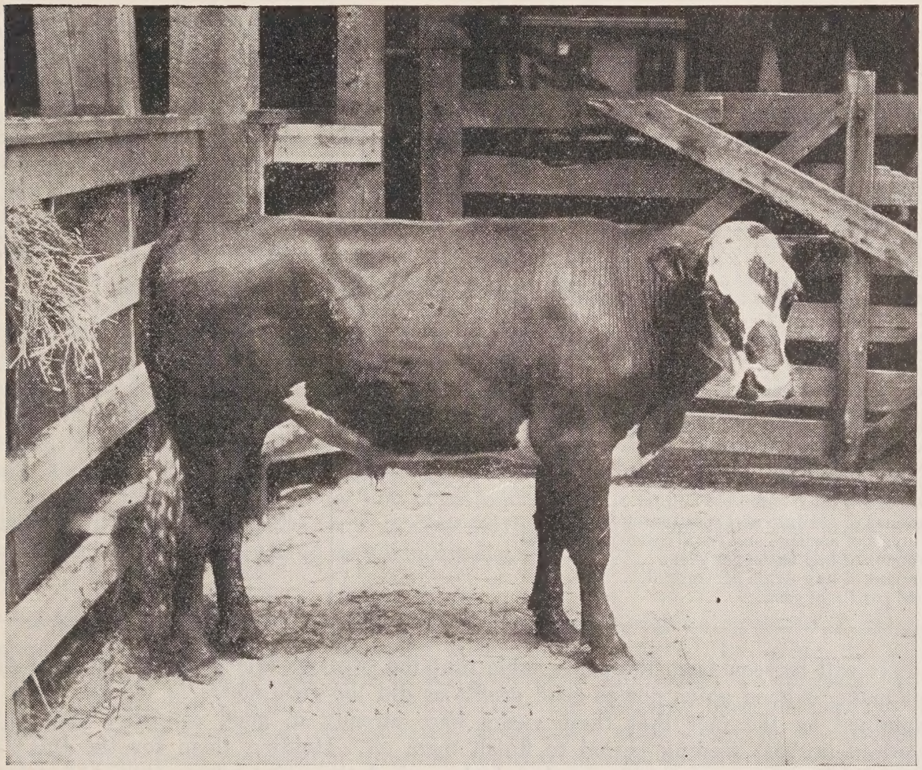


CHART 4.—Four Year Average of Monthly Receipts and Average Price of Undermentioned Grades in Ontario, 1918-19 Inclusive.



bought on a much wider margin than the higher grades, in fact, the economy of such buying is ever in doubt. Steers of good breeding and type and in good feeding condition should be bought in preference. A premium of one-half to one cent can be paid for these as compared with common stock. The same class of steers, if in extra good condition yet not fat, can be bought on an even narrower margin for a shorter feeding period and subsequent quick turnover. Usually, however, there is a greater risk with this latter class of steers. Should the price drop just as they were finished and ready to market, only a rapid recovery would permit of other than a loss.



A first-class feeder.

The breedy steer can usually be picked out at a glance. He will show the colour markings of the breed predominating in his ancestry, be it Aberdeen-Angus, Hereford or Shorthorn. If breed, type and character, as shown, do not identify the breed or breeds of his immediate ancestry, he may not prove a very promising prospect as a feeder. Briefly, the beef type of animal is exemplified by the bullock compact and broad of back from shoulder points to hips; with a wide deep body; short and somewhat thick neck; wide, deep, full breast; and broad, thick, fleshy, hind quarters, all smoothly and well fleshed giving the animal a compactness and squareness of form neatly described as "blocky". If the body has too great length, the animal is termed "rangy"; while animals long of leg and shallow bodied are termed "leggy". These latter two types should be avoided as they are almost invariably poor doers. Along with the blockiness referred to, quality is required. Quality is shown in fine, clean, strong bone; comparatively fine horns; a medium thick, soft, pliable skin covered with a fine mossy coat; and fine, neatly attached appendages such as ears and tail. An important point is the indication of good feeding qualities as shown by the general condition of the animal, as well as by a broad strong muzzle and nostrils and

a clear, placid, full eye. Another point is, that other things being equal, the heavier the steer the greater the possibility of profit. This will be discussed again under "spread".

To emphasize the advisability of careful selection of steers table II is presented:—

TABLE I.—RELATIVE GAINS IN WINTER FINISHING OF GOOD vs. POOR TYPES OF STEERS

—		Lot I	Lot II	Lot III
		Superior Steers	Good Steers	Poor Steers
Number of steers in lot	No.	9	8	8
First weight	lbs.	11,370	8,890	8,300
Average	"	1,263	1,111	1,037
Finished weight	"	13,480	10,985	9,990
Average	"	1,497½	1,373	1,248
Total gain in 116 days	"	2,110	2,095	1,690
Average	"	234	262	211
Daily gain per steer	"	2·02	2·26	1·82
Gross cost of feed	$	161 25	140 73	145 40
Cost per 100 lbs. gain	$	7 64	6 72	8 60
Buying cost of steers per 100 lbs	$	4 00	3 50	3 00
Total cost of steers	$	454 80	311 15	249 00
Selling price per 100 lbs	$	5 25	5 25	4 50
Total selling price —less 4%	$	679 39	553 66	431 59
Profit	$	63 34	101 78	37 12
Net profit per steer	$	7 04	12 72	4 65
Average buying price per steer	$	50 53	38 89	31 13
Average selling price per steer	$	75 49	69 21	53 95
Average increase in value	$	24 96	30 32	22 82
Average cost of feed per steer	$	17 92	17 60	18 18
Amount of meal eaten by group	lbs.	6,670	5,936	6,326
Amount of meal eaten per animal	"	741	742	790
Amount of ensilage and roots eaten by group	"	66,776	57,048	57,048
Amount of ensilage and roots eaten per animal	"	7,419	7,131	7,131
Amount of hay eaten per group	lbs.	5,022	4,408	4,464
Amount of hay eaten per animal	"	558	551	558
Meal per lb. of gain	lbs.	3·16	2·84	3·74

It will be seen from the above table that the superior type of steers in lot 1 did not make as good gains nor as good profits as did the good steers in lot II. This is explained by the fact that these steers were already in good condition and only required a short feeding period to finish them off. Holding them for the full 116 days did not prove profitable as they had reached the point where they had ceased making economical gains. However, the good steers in lot II thoroughly demonstrated their ability to make greater gains at a greater profit than the poor steers in lot III.

To further emphasize this point table II, giving the average results of three years' experiments, is presented:—

TABLE II

—		Lot I	Lot II
		Good type Steers	Poor type Steers
Buying price per cwt	$	4.55	4.09
Selling price per cwt	$	6.08	6.00
Daily gain per steer	lbs.	1.97	1.64
Meal consumed per pound of gain	"	2.93	3.37
Cost per pound of gain	$	7.22	8.41
Profit per steer	$	9.00	2.54

Here again it will be seen that the good type steers in lot I bought at a higher figure and sold for a higher figure but on a narrower margin made both greater gains and greater profits than the poor type steers in lot II. The inferior seters did not make as much nor as economical gains and were discounted on the market, consequently they were a losing proposition from the start as compared with the good type steers.

DEHORNING

The advisability of dehorning feeding cattle has come in for even greater attention than usual during the past year. Resolutions advocating in unqualified terms the value of such practice to all concerned have been tabled at many important conventions of live stock men. (See Pamphlet No. 15.) It has therefore been deemed advisable to devote some space to a consideration of ways and means in connection with this work. Further, while the question of winter steer feeding as discussed in these pages has reference more particularly to Ontario conditions, considerable data is presented, resulting from experiments in dehorning cattle on the Dominion Experimental Farms generally.

THE VALUE OF DEHORNING

In the purchase of feeder and stocker cattle for experimental feeding on the Experimental Farms, an effort has always been made to purchase dehorned animals, in that they may be stabled more economically and generally cared for more easily, make better gains, and are much less liable to bruises and injury during the feeding period, and particularly in transit to and from the feeding quarters. Where box-stall, corral or shed methods of feeding have been anticipated, or, in short, where steers have been fed loose, either dehorned cattle have been purchased or the horned cattle have been dehorned as soon as they arrived on the premises. The practice of dehorning has been considered as an indispensable feature in the finishing of market cattle.

Dehorning a Humane Practice.—The operation of dehorning is to a certain extent a painful one; nor is there any means of lessening or deadening the pain. Dehorning is the choice of two evils, as being markedly the lesser. To appreciate that it is the lesser, the doubtful reader should make the following observations: (1) an inspection of the carcases of horned cattle, particularly after a long railway journey, or killed right from the feeding quarters, for that matter; bruises and rips will be seen that have a serious effect on value, but that from the humane standpoint indicate more general concern—previous suffering of the live animal from injuries hidden until revealed by slaughtering and dressing; (2) an inspection of a mixed lot of horned and dehorned or muley cattle; the suffering and deprivation from insufficient food of the more defenceless individuals will readily be seen.

The Effects on Profits.—The foregoing deals with the humane side of the case. In a purely monetary consideration, the stockman loses out where dehorning is neglected, because (1) he gets less for his finished steer, either horned or dehorned *in a mixed lot,* as will be dealt with specifically; incidentally, he is enabled to get a premium over the market for a straight lot of dehorned or hornless stockers or feeders; (2) his animals, where fed in mixed lots (horned and dehorned), will finish unevenly; the hornless steers, after painful experience, become timid and refuse to come up to the feeding racks and mangers until the bulk of the feed is gone, with the result that the horned steers develop still more into bullies, get too much feed, and frequently develop digestive trouble, while the disarmed animal is under-nourished, making poor gains, which, coupled with bruising and liability to really serious injury, make him all too frequently responsible for lowering the average profit, per steer, in the lot.

METHOD OF DEHORNING

The methods employed in dehorning cattle on the Experimental Farms are as follows:—

1. The prevention of horn development in the calf.
2. The use of a fine-toothed dehorning or meat saw.
3. The use of dehorning shears.

The Prevention of Growth.—In the case of beef-bred calves destined to be finished for the block or of calves of the dairy breeds where horns are considered a menace, the practice is to treat the calf before it is ten days old. In the outset it may be stated that *the treatment must be thorough and the caustic agent used up to strength,* or malformed horns, of all shapes and designs, will develop. Caustic Potash in stick form is recommended; Gillett's Lye may be used. Clip the hair away from the buttons, wash with soap and water and dry. Apply vaseline or crude petrolatum so that it covers the head *for an inch or so about the margin of the button,* being careful to see that no vaseline covers the buttton itself. The vaseline prevents injury to the skin surrounding the button. Take a stick of Caustic Potash, wrap it in paper as a protection to the hands, moisten the tip of the stick and rub it on the buttons. Two methods are recommended—(1) rub the buttons gently for three to five minutes until they become red; (2) rub on three or four times, at intervals, allowing the potash to dry on the horn button each time. The latter method will generally give better results.

Precautions:—

1. Protect the hands.
2. Do not let the dissolved potash run over other parts of the head.
3. Tie calves up or separate them so that they cannot lick one another.
4. Do not let water or rain fall on their heads for a few days.

Where calves are older than a week or ten days and some horn development is present—a condition often met with where this operation is done at branding and castration time on the range,—a widely used plan is to cut the top off the horn, avoiding causing bleeding, if possible, and then rubbing on caustic potash, or, a paste made of Gillett's Lye and applied with the blade of a knife.

Preventing the growth of the horn in the manner described in the foregoing paragraphs is, in point of simplicity, economy, effectiveness and humanity, greatly to be preferred to all later discussed methods of dehorning. The calf suffers some slight pain for an hour or two, and, provided the *treatment has been carefully applied,* his troubles are over, in so far as horn removal is concerned.

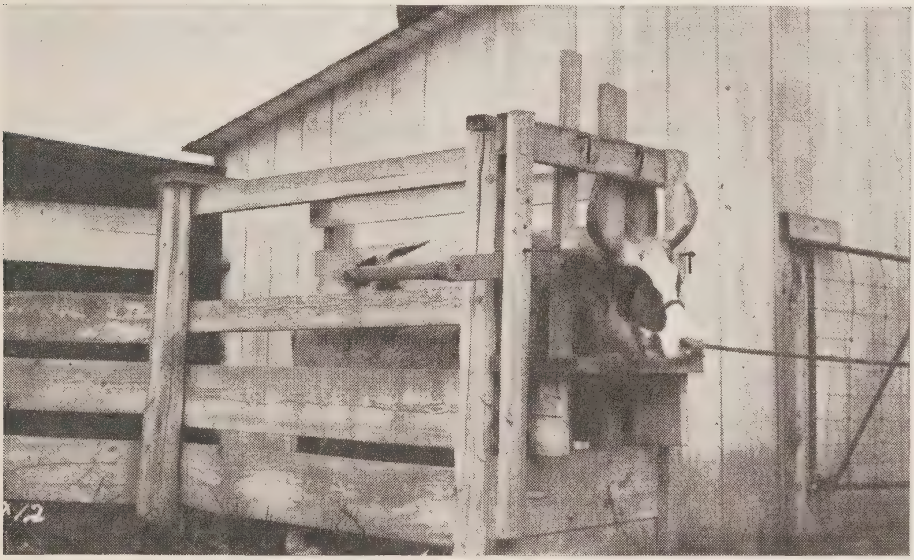
Dehorning by Means of Saw.—On a number of farms the ordinary fine toothed meat saw has been used. There is, too, a special dehorning saw manufactured. Such a tool will do effective work provided that it is sharp and of high quality steel and that the animal be very securely held. The objection to this method is that it is slow and the period of intense pain prolonged.

Special Dehorning Devices.—There are several dehorning shears or clippers. On several of the Farms and Stations the Keystone Dehorner is used with great satisfaction. This device, properly used, removes the horn almost instantaneously and leaves a relatively clean cut. A precaution to be observed is in the setting of the clipper well down over the base of the horn where the bony tissues are more open. Trying to remove the horn higher up, where, in some cases, the texture is extremely fine and flinty, may snap or break the cutting edge of the highly tempered knives. The Dr. Leavitt Dehorner is another well-known instrument, similar in principle to the Keystone. Both may be procured through veterinary or stockmen's supply houses, such as the Ontario Veterinary and Breeders' Supply, Ltd., 72 Dundas St., E., Toronto, or the Winnipeg Veterinary and Breeders' Supply, Ltd., Winnipeg, Man.

Other dehorning devices are as follows: The Perfection Calf Dehorner, specially designed for effective destruction of horns in calves; the Convex Dehorner; and the Newton & McGee Dehorner. The latter devices have not been tried on the Farms and are listed by Messrs. Sharp & Smith, of 157 N. Michigan Boulevard, Chicago, Ill.

Care and Use of Dehorners.—While being used, the dehorning device of whatever nature it may be, should be stood, between removals, in a pail or bucket of fairly strong creolin or other disinfectant solution. This is a useful precautionary measure and tends to keep the blades free from blood-clots, hair, etc.

Dehorning Stanchions, Chutes, etc.—There are many arrangements employed to hold the animal's head securely during the operation. A rather complete arrangement is in use at the Experimental Station at Summerland, B.C., in the form of a combined squeeze and stanchion or bale. A heavy, swinging gate acts as a



Dehorning chute at Central Experimental Farm, Ottawa.

squeeze. The steer is driven in through the wings of the chute and when his head is through the stanchion, the bale is closed and the head held down tightly with a crow bar through slots in the bale.

Another simple type of dehorning chute is as illustrated and as in use at the Central Experimental Farm, Ottawa. This is simply equipped with a wing and stanchion, and has proven entirely satisfactory. Several other types of dehorning stanchions and chutes are giving satisfaction over the Branch Farm System. Space does not permit of illustration thereof. In general, any mechanical arrangement that provides the main essential—holding the animal's head rigidly—will be found satisfactory. The interested reader is referred to Pamphlet No. 15 (Live Stock Branch or Experimental Farm, Ottawa), in which publication further illustrations are shown.

PREVENTION OF EXCESSIVE BLEEDING, INFECTION, ETC.

Before taking up in detail data as collected over the Experimental Farm System with reference to immediate losses in weight incidental to dehorning, comparative losses, cost of operation, etc., it would be well to deal briefly with precautionary measures.

Time to Dehorn.—Cattle should not be dehorned in very cold weather or in fly-time. In the first instance, serious inflammation may set up; in the second, the

possibility of trouble is much greater due to the hatching of eggs laid by flies, the development of the larvae in the cavities laid bare, and ensuing suffering and infection. March, April, October and November are the favourable months.

Bleeding.—Excessive bleeding is rare. However, to the person not accustomed to the operation, it appears sanguinary enough. On several of the Farms no attempt is made to stop the natural flow, on the assumption that the free flow of blood prevents inflammation and pus formation. In the healthy normal animal the fibrin of the blood readily coagulates forming a clot over the exposed stump. The foregoing is the usual procedure. Nevertheless, the Experimental Station at Charlottetown, P.E.I., follows the practice of applying cold water to the parts, having in view the well known styptic qualities of the latter. Applications of creolin and tar have not given as good results as the cold water. At Ottawa, the application of vegetable tar to the exposed parts, has been tried. While this substance undoubtedly has disinfectant properties, is of an adhesive nature, and probably assists the healing process, the main virtue of its application is apparent when there is some danger from flies, as described. In cases of excessive and continued bleeding, the application of flour is advised.

Infection.—In a few cases infection of the horn has set in from one reason or another. At Summerland, B.C., for example, in many carloads of steers dehorned trouble due to infection has been met with in only two cases, in each of which cases the steers had abnormally heavy, flinty-hard horns. Inflammation, pus-formation and considerable pain to the animal resulted. These steers were tied up twice daily and the horn cavities syringed out with hydrogen-peroxide and water, forcing the liquid well in. Afterward, iodine was used as a dressing. Solutions of potassium permanganate or creolin might be used instead of the peroxide; iodoform or even slaked lime could be applied last. Incidentally, one of these steers started feeding, weighing 1,220 pounds, and finished at 1,550 pounds; the other started at 1,130 pounds and finished at 1,352 pounds. The horn infection was cleared up in a week and the steers thereafter made good gains. This is typical of the case in point, the Farm System over. Occasional cases of infection have been met with. Such cases lend themselves readily to simple treatment. No individuals have been lost. In two instances in many thousands of dehornings, steers have died in the chute. In both cases, the steers were particularly wild and unruly and died of shock. The carcases were bled, dressed, and disposed of without loss.

THE COST OF DEHORNING

The cost of dehorning cattle is made up of labour charges almost entirely. Dehorning devices cost from $10 to $15 each. The cost of a chute and stanchion will depend on how complete or elaborate it may be—say, $10 or thereabouts. On the Experimental Farm System costs of dehorning have varied slightly. The following figures and estimates have been supplied:—

Charlottetown, P.E.I.—Four men dehorned sixteen steers in two and a half hours; cost per steer, 18¾ cents.

Kentville, N.S.—Five men dehorned twenty-four steers in three hours; cost per steer, 19 cents.

Nappan, N.S.—Six men dehorned at rate of one steer in six minutes; cost, 18 cents.

Lethbridge, Alta.—Three men dehorned sixty steers in half day; cost per steer, 6 cents.

Summerland, B.C.—Range steers were dehorned at the rate of six in twenty-five minutes; cost per steer, 15 cents (approx.).

The cost per steer may be approximately figured at from 15 to 18 cents per steer.

LOSSES OF WEIGHT RESULTING FROM DEHORNING

Charlottetown found in an experiment with twenty steers which had an average weight before dehorning of 901 pounds, that at the end of two weeks after dehorning they had gained on the average about 47 pounds.

This Station practises dehorning when necessary and for a period of years dating from 1912 to 1921 did not lose a single steer from the results of dehorning and had only three steers which gave trouble from infection after dehorning.

Kentville found that eight steers dehorned and running loose made somewhat greater gains than a similar number not dehorned and tied in the stable. In a period of 120 days the dehorned lot made an average of 23 pounds more gain than the horned and tied lot.

A similar experiment conducted in 1915-16 showed practically no difference in favour of either methods, both lots making practically the same total gains.

Nappan found that 149 steers averaging 1077·15 pounds before dehorning, at the end of three weeks showed an average loss in weight per steer of 39·7 pounds. Explanation in part at least for this shrinkage may be due to change of food and surroundings.

Another lot of twenty-four steers were weighed and dehorned, and at the end of a three weeks' period showed an average gain in weight of 41 pounds.

Brandon.—Two years' results at this Farm showed that lots of steers which were horned and tied made an average daily gain of 1·5 pounds; dehorned and tied lots made average daily gains of 1·5 pounds; and dehorned and loose steers made average daily gains of 1·5 pounds. In 1909, horned steers tied in stalls made average daily gains of 1·2 pounds, while dehorned and loose steers made average daily gains of 1·7 pounds.

Indian Head.—Two experiments were conducted with this particular object in view. One lot of horned steers which were tied made gains of 50 pounds in the first four weeks, while a similar lot in another experiment showed gains of 110 pounds. A dehorned lot, which was tied, showed a loss in four weeks of 200 pounds, while a similar lot showed gains of 140 pounds. Another lot dehorned and loose showed gains for the four-week period of 60 pounds, while another lot similarly handled made gains of 325 pounds.

Results from these tests indicate that, while there may be a slight loss at the beginning of the feeding period after dehorning, this loss is recovered later in the feeding period.

Summerland found that out of forty-seven steers which were dehorned and fed in 1918-19 at the end of a two weeks' period after dehorning only two steers showed loss of weight, while at the termination of a feeding period of 103 days substantial gains were made in all cases.

PERIOD OF RECOVERY

Charlottetown.—This Station found that between the years 1912 and 1916, 100 per cent of the steers showed immediate recovery, while for a period of nine years only three steers suffered from infected horns, all of which subsequently recovered. On the average about one month was required to heal the wounds.

Kentville.—An average loss of 25 to 35 pounds in weight covering a period of about two weeks, after which gains are very rapid, was the experience of this Station.

Summerland.—Steers recover from the shock of dehorning after a period of about three weeks.

Scott.—Recovery after dehorning requires about three weeks on the average.

Indian Head.—Results from tests conducted at this Farm indicate that while there may be a slight shrinkage after dehorning, the loss is recovered later in the feeding period. The most severe cases require not more than two months to completely recover from the effects of dehorning.

RELATIVE GAIN BETWEEN DEHORNED CATTLE AND THOSE WITH HORNS LEFT ON

Indian Head.—One lot of horned steers (tied) at the end of a sixteen-week feeding period showed total gains of 790 pounds, while another lot of dehorned steers which were also tied, showed gains totalling 600 pounds. A third lot, dehorned and running loose, gave total gains of 1,090 pounds.

A second experiment similar to the above gave a total gain for horned and tied steers of 770 pounds, for the dehorned and tied steers 895 pounds, and the dehorned and loose steers a total gain of 910 pounds.

From these results dehorning would seem to be decidedly beneficial, resulting in considerably greater gains.

These results indicate in the vast majority of cases that dehorning did not materially reduce the weight of the steers and that by the end of a two to four weeks' period the steers would usually be showing substantial gains. Further, dehorning permits of the steers being allowed to run loose and this practice has undoubtedly been conducive of increased gains.

It would also seem that the slight bleeding which results from dehorning is beneficial and that by the end of the fattening period any check which the steers may have suffered is more than counterbalanced by increased gains in weight.

THE RELATIVE GAIN BETWEEN ANIMALS DEHORNED AFTER PURCHASE AND THOSE PURCHASED HORNLESS

Rosthern.—Fifteen horned steers purchased and dehorned, after a period of two weeks, showed an average shrinkage of ten pounds. Five hornless steers, purchased, at the end of the same period showed a gain in weight of 48 pounds, thus giving a difference in favour of the latter of 58 pounds for a period of two weeks.

Scott.—Thirty-five steers dehorned after purchasing averaged a gain of 31 pounds for the first month. Seventeen hornless steers made average gains of 59·9 pounds for a similar period. This indicates that the dehorned steers made an average of 28·9 pounds less than the hornless steers. For the entire feeding period the hornless steers made an average gain of 231·1 pounds, while the dehorned steers averaged 186·3 pounds, or an average of 44·8 pounds less for the total feeding period.

Lacombe.—Steers purchased dehorned and turned on pasture shrunk on the average 35·2 pounds in one week, while those dehorned and placed on pasture shrunk 58·9 pounds, or 23·7 pounds more than those that had previously been dehorned. Further results are not available in connection with this experiment.

Summerland.—Ten steers have shown a loss of weight as a result of dehorning when weighed two weeks afterwards, and the vast majority continued to make gains with no check of any sort. In a test, the duration of which was 103 days, a total of twenty-seven dehorned steers showed an average gain in weight of 193 pounds. Three muley steers fed at the same time under similar conditions made average gains of 116 pounds. These latter steers were wild and as a result poor feeders.

In 1919 four muleys made average gains of 315 pounds, as compared to seventeen dehorned steers which made average gains of 252 pounds.

In 1920-21 a total of forty steers for a feeding period of 109 days, made an average gain of 269 pounds. During 1922 sixteen muley steers for a period of 109 days made an average gain of 285 pounds, while twenty-five dehorned steers made average gains of approximately 278 pounds, or an average of 7 pounds less.

These results show the muley steers to have averaged slightly superior gains to the dehorned steers.

Nappan.—Six horned steers were dehorned and fed for a period of ninety days, after which period they showed an average gain of 213 pounds. A lot of steers pur-

chased dehorned, for the same feeding period, gave an average gain of 154 pounds. The difference in weight for the period immediately following the dehorning is not available. Other experiments, however, point to the fact that, while dehorned steers may show poorer gains for the initial stages of the feeding period, throughout the latter stages such steers frequently make considerably greater gains than horned steers or those bought dehorned.

FEEDING HORNLESS AND FRESHLY DEHORNED STEERS IN THE SAME LOT

It will readily be understood that the freshly dehorned steer, for a few weeks, seeks to avoid any chance of injury to his sensitive head. His brothers, in a dehorned state of some standing, naturally show him little consideration. It is every man for himself at the feed trough or rack. All of which, added to the slight losses in weight incidental to shock, etc., will tend to lengthen the period of recovery, in that, the main object of the freshly dehorned steer for a few days will be to keep away from his crowding mates. He does not get enough to eat.

It is wise, therefore, where steers are fed loose, to segregate, if possible, the freshly dehorned individuals. They are more careful of themselves—and of their mates as a result. Some feeders go so far as to tie up freshly dehorned steers for a couple of weeks or until the healing process has become well established and the steer more normally aggressive. In the experimental evidence offered, some of the slight differences in findings may be attributed to the fact that the steers, in some cases, were of mixed lots concerning the point in question.

THE PREMIUM ON DEHORNED FEEDERS, STOCKERS AND FINISHED CATTLE

Scott.—The most discriminating western buyers demand a spread of 25 to 75 cents per hundred pounds between horned and dehorned finished cattle.

Lacombe.—Dehorned steers command a premium of 25 to 50 cents per hundred pounds over the horned, depending on the length and size of horn, this pertaining more particularly to the stocker and feeder rather than the market steer.

Indian Head.—If cattle are dehorned they find a much more ready sale during the heavy run at a slight premium, usually from 25 to 50 cents per hundred pounds. On the other hand, when cattle are scarce and very much in demand, there is very little premium paid on dehorned steers.

Summerland.—Last fall (1921) 10 cents a hundred more was paid for dehorned feeder steers over and above the price paid for horned steers.

Rosthern.—Seven years' experience at this Station results in the estimate that a dehorned steer is worth a premium of 30 to 50 pounds over a horned steer when entering the feed lot.

These results show that a premium is paid for dehorned stockers and feeders in the West when the supply of steers is not limited. When the supply is limited, little or no distinction is made between horned and hornless steers.

From the foregoing it would appear that there is a distinct margin of profit between the cost of dehorning and the premium, which may be expected on this class of stock. The man who prevents the growth of horns on his calves, destined for sale as stockers and feeders, and the ultimate buyer of these cattle, may both expect a direct return aside from the fact that such stock will make more economical gains in the feeding quarters or on range, other things being equal.

AGE OF STEERS TO FEED

Age is one of the important considerations in the selecting of steers for feeding work. Of course, other factors such as condition, feeds available and spread are interlinked with age to such an extent that no hard and fast rules can be laid

down. Table III shown herewith gives the results of six years' experiments comparing three-year-olds, two-year-olds and yearlings.

TABLE III.—INFLUENCE OF AGE ON COST OF BEEF AND ON PROFITS

Years	1900			1901			1902		
Class of Steers	3 yr.	2 yr.	1 yr.	3 yr.	2 yr.	1 yr.	3 yr.	2 yr.	1 yr.
Initial weight.......... lbs.	1,118	960	808	1,217	970	873	1,290	1,072	953
Total gain per steer.......... "	287	271	213	338	332	315	307	311	345
Purchasing price.......... $	3 75	3 50	3 25	4 25	3 50	3 38	4 00	4 00	4 00
Selling price.......... $	4 75	4 65	4 50	5 12	5 00	4 77	6 17	6 17	6 17
Spread.......... $	1 00	1 15	1 25	0 87	1 50	1 39	2 17	2 17	2 17
Average daily gain.......... lbs.	1·53	1·49	1·11	1·58	1·58	1·55	1·65	1·67	1·85
Cost per 100 lbs. gain.......... $	6 08	6 20	5 00	6 37	5 70	5 77	6 22	5 70	4 65
Profit per steer.......... $	5 22	6 77	9 05	5 29	8 88	6 04	16 53	20 70	26 07

TABLE III.—INFLUENCE OF AGE ON COST OF BEEF AND ON PROFITS—*Con.*

Years	1903			1904			1905		
Class of Steers	3 yr.	2 yr.	1 yr.	3 yr.	2 yr.	1 yr.	3 yr.	2 yr.	1 yr.
Initial weight.......... lbs.	1,269	1,079	965	1,237	967	808	1,208	1,070	483
Total gain per steer.......... "	284	298	298	294	327	242	210	275	387
Purchasing price.......... $	4 90	4 90	4 90	4 00	3 90	3 50	4 00	4 00	4 00
Selling price.......... $	5 25	5 25	5 25	5 00	4 85	4 75	5 00	5 00	5 00
Spread.......... $	0 35	0 35	0 35	1 00	0 95	1 25	1 00	1 00	1 00
Average daily gain.......... lbs.	1·58	1·65	1·65	2·28	2·53	1·9	1·65	2·16	2·00
Cost per 100 lbs. gain.......... $	7 05	6 03	5 54	5 22	4 30	5 62	6 52	5 99	4 30
Profit per steer.......... $	−4 78	−3 70	−2 95	7 87	7 92	5 50	7 55	6 12	7 54

Variations will be noted from year to year. However, the yearling steers gave the greatest profits in three years out of the six. They were second one year, 1901 only because of an extra spread realized by the two-year-old steers and second another year, 1905, by the narrow margin of one cent per 100 pounds. They were third one year, 1904 because of poor gains made possibly on account of being poor feeders as compared with the two-year-olds and three-year-olds that year. The two-year-olds gave the greatest profits twice, came second three times and last once. The three-year-olds came first once, second once, and third four times. Table III A gives an average of the figures on table III, which makes the situation clearer.

TABLE IIIA.—INFLUENCE OF AGE ON COST OF BEEF AND ON PROFITS. AVERAGE FOR SIX YEARS

	3-yr.-olds	2-yr.-olds	Yearlings
Initial weight.......... lbs.	1,229	1,019	815
Total gain per steer.......... "	290	302	300
Purchase price per cwt.......... $	4 23	3 96	3 84
Selling price cwt.......... $	5 21	5 15	5 07
Spread.......... $	0 98	1 19	1 23
Average daily gain.......... lbs.	1·71	1·84	1·67
Cost per cwt.......... $	6 24	5 65	5 14
Profit per steer.......... $	6 28	7 78	8 54

Here it will be noticed that the two-year-olds made the greatest gains, but the yearlings were a close second and the three-year-olds but slightly lower. It is in the cost per pound gain that the younger steer has the advantage, as it will be noted that the cost increases in proportion to the age. The lower feed cost of the younger

steer is due to the fact that he is growing and putting on fat at the same time whereas the three-year-old steer has about reached the limit of his growth and makes his gains by putting on fat alone—a more expensive process. One factor not brought out in the table is that the younger steer takes a somewhat more nutritious ration than the older steer. If there is much coarse roughage to be consumed, undoubtedly the older steers would make the best use of it. All things considered the average feeder would be well advised to feed two-year-olds. If he has to make a choice between yearlings and three-year-olds he should choose the former, especially on a doubtful market, as he may hold them longer without the same risk of loss.

SHORT VS. LONG KEEP STEERS

The two determining factors in deciding whether steers should be fed for a short or a long period are: (1) the kind of cattle to be fed, and (2) the relative supply and cost of grain and roughages.

From the standpoint of the feeder with cattle on hand, the young fleshy animal and the more mature animal, also fairly well fleshed, will put on the necessary finish to give a good spread between cost or buying price and selling price, in comparatively short time. On the other hand, the young thin animal, or even the mature thin animal, requires a longer period in which to acquire the fleshing and finish necessary to make first class beef, consequently can be carried in the feed lot for a longer period and still leave a chance for profit for the owner. This division of the various classes of animals from a short and long feeding period standpoint is further strengthened by the fact that the nearer steers get to a finished condition, the higher the cost per pound gain; so that in two lots divided, as outlined above, at the end of a sixty or seventy-day feeding period on similar rations, the well fleshed steers would be making gains at a cost which would have about reached the limit in so far as expected profit would be concerned, while the thinner steers would still be making fairly profitable gains.

Looking at the problem from the standpoint of feeds available and the cost of same, as in the case of the feeder who has to buy his cattle, the situation changes somewhat. If the feeder has a limited supply of good roughages and a fairly liberal supply of the necessary fattening grain feeds or can procure the latter at economical prices, then his best proposition would be to buy good or choice feeders, push them to a finish and turn them off again just as quickly as the desired finish is reached. If, on the other hand, the feed which he wishes to make use of consists of cheap home grown roughages, otherwise unmarketable, and in considerable quantity, then he would be liable to make a greater profit by buying animals of the stocker class as they will make the best use of such material.

Table IV shows the average gain per day, per steer, and average profits per steer from twelve experiments made with the object of determining the relative profit of short and long keep steers.

TABLE IV

Average for 12 lots	Short fed Steers, less than 150 days	Long fed Steers, more than 150 days
Gain per day per steer....lbs.	2·11	1·54
Cost per pound of gain....cents	5·29	7·93
Profit....$	8·03	2·46
Days....	112	344

The short fed steers made on the average greater gains per day at less cost per pound of gain and left a higher profit to the feeder.

On the whole it has very seldom proven profitable to carry over into the summer months steers that were ready for the block in early spring, because stall feeding of steers during the summer months is too expensive. Very often steers will lose weight during the heat of July and August.

Long feeding of steers, with present high prices for meals, and particularly in the absence of much cheap roughage, leaves but a small margin of profit, even with a spread between buying and selling prices of over $1.50 per cwt.

The only case where long feeding might prove profitable would be that of a farmer having large quantities of fairly good quality roughage, hay and ensilage. Here a maximum roughage ration and a minimum grain allowance would mean slower gains and a longer feeding period.

SPREAD

In the case of the feeder who has to purchase his cattle, a vital factor is that of margin or spread required between buying and selling price to allow a profit. Two points are of importance in this connection: First, other things being equal, the higher the purchase price of the cattle the smaller the margin necessary to break even. That is, a 1,000-pound animal costing $7 per cwt and gaining 300 pounds at a cost of $12 per cwt. would have to sell for $8 per cwt. to break even. This would give a margin of $1 between buying and selling price. If the same animal was bought at $10 per cwt. and made the same gains at the same cost it could be sold for $10.46 per cwt. and still break even, in which case the margin required to break even would be only 46 cents per cwt. Secondly, other things being equal, the heavier an animal is when placed in the feeding pen, the smaller the margin necessary between buying and selling price to leave a profit, the advance in selling price being obtained for a greater number of pounds on account of the higher initial weight. For instance, a 1,000-pound animal bought for $5 per cwt. making 200 pounds gain and sold on a 2-cent spread yields a gross profit of $34, while a 1,100-pound animal under the same conditions would give a gross profit of $36, the extra $2 profit being made up of the 2 cents a pound spread on the extra 100 pounds initial weight. This does not hold true, however, for animals that have attained their increased weight, through age and consequent maturity. In such cases the gains made are more expensive, as already discussed.

In times of high prices for feeds a greater spread is obviously necessary. The degree of finish is also an important factor in determining a profitable spread. In the case of very highly finished steers a special price must usually be obtained to cover the extra cost of putting on the high finish. The last few pounds of high finish are, in all cases, the most expensive. Unless that the feeder is so placed to take full advantage of a market for high grade beef, it is doubtful if the extremely high finished animal is the most profitable one. However, the probability of any excess number of highly fitted steers is remote as the millenium.

Table V gives the average conditions of the market and results as regards spread in price or margin between buying and selling price of steers fed at the Central Experimental Farm, Ottawa, over a period of twenty-five years.

TABLE V

—	Buying Price	Selling Price	Spread	Profit per Steer
	$ cts.	$ cts.	$ cts.	$ cts.
Average for 25 years	5 23	6 82	1 59	8 60
Spread $1.60 and over	4 87	6 93	2 06	12 88
Spread less than $1.60	5 48	6 73	1 25	5 20
Largest spread	2 50	6 50	4 00	17 77
Lowest spread	4 90	5 25	0 35	−3 60

It will be seen that the average spread was $1.59 on which average spread a fair profit was made. It will also be noticed that a spread of only $1.25 still yielded a profit but that a spread of only 35 cents was a losing proposition. It would take steers of exceptionally good quality, carefully fed, to yield a reasonable profit with a spread of less than $1. A spread of $1.50 to $2 per cwt. should be the aim of the feeder.

THE COST OF FEED, POUNDS GAIN, AND POSSIBLE PROFITS

Some of the first questions that the prospective feeder is bound to ask of himself are: "What will it cost me to fatten this lot of cattle?" and "How much gain will they make per day?" "What profits may I expect?" To answer these depends on a number of factors, some already enumerated, including the quality of the steer, the time at which he is marketed, the degree of finish attained, the cost of putting on that finish and the spread or margin between buying and selling price.

In the first place it must be remembered that the feeding of steers is a method of converting home-grown roughages—some of which have no market value, especially in years of heavy crops, or with a market value adversely affected by high freight rates—into a marketable product subject to a reasonable freight rate. Furthermore, there is to be considered the increased fertility of the farm, due to the feeding of these roughages and grain feeds of which at least 50 per cent of the fertilizing elements are returned to the soil when the manure is properly handled. This increased fertility is a feature that cannot be accurately measured in terms of cash, but it can certainly be taken to be equivalent to the cost of bedding, labour, interest on investment and depreciation on buildings and equipment on the ordinary farm.

Assuming that the quality of the steers and the finish attained are up to a good standard, table VI will give an idea of the amount of feed consumed, the pounds gain made, the cost per pound gain and the profit over feed. Table VI constitutes the average results obtained from twenty-five lots over a period of fifteen years. Prices used were those obtaining at the time the respective experiments were conducted.

TABLE VI.

Meal consumed per day	lbs.	4·35
Silage and roots consumed per day	"	43·2
Hay consumed per day	"	5·00
Meal consumed per lb., gain	"	2·27
Silage and roots consumed per lb. gain	"	22·6
Hay consumed per lb. gain	"	2·6
Daily gain per steer	"	1·91
Cost per lb. gain	$	6·24
Profit per steer	"	8·70

These figures are in some respects a little low, but it must be remembered that some of the experiments were conducted over twenty years ago and again that some of the animals were less than a year old at the start of the experiment. The figures for feed consumed and those for daily gain bear what might be called a usual relation to one another, so that by calculating the feeds given at prices prevailing, knowing the cost of the steers and allowing for a fair spread, a fairly accurate idea of the profits under present conditions can be arrived at.

BUILDINGS

In the matter of buildings, the policy of the feeder should be to make the best use possible, consistent with convenience, of those at his disposal and not add to his overhead charges by unnecessary construction. Expensive buildings are not necessary and often add to overhead expense and to labour. If indoor accommodation in tie-up or box-stalls is available, good use can be made of it, provided the arrangement is convenient for feeding and cleaning out. Table VII gives the result of four trials of feeding steers loose in box-stalls vs. tied, all inside.

TABLE VII.—LOOSE vs. TIED, ALL INSIDE

—	Loose	Tied
Daily gain per steer.......... lbs.	1·94	1·82
Cost per 100 lbs. gain.......... $	5 93	6 14
Profit per steer.......... $	9 74	8 94
Meal consumed per lb gain.......... lbs.	1·75	1·90

It will be seen that those kept loose in box-stalls made greater gains, at less cost, and consequently greater profit than those tied in stalls. In this experiment feed cost, only, is considered. More equipment and labour is necessary for those tied up, which would make the case still stronger for those kept loose in box-stalls. Steers fed loose, in comparatively small box-stalls, should be even in size and similar as to disposition. One wild steer in a group is liable to make the others restless, preventing them from doing as well as they otherwise would.

Where indoor accommodation is not available, steers can be fed outdoors equally if not more economically. A good type of outdoor shelter is shown in the cover illustration. This consists of a single boarded shed facing south, a large door in the front being left open at all times. Across the yard is a covered feeding trough over which is placed the hay rack. Doors open to the outside from both the feed trough and hay rack so that the feed can be forked in direct from a sleigh or cart in a very few minutes. Steers have been fed in these sheds throughout the most severe winters with excellent results. Provided the silage and hay are convenient the labour of feeding is reduced to a minimum. Cleaning out the manure is done away with until spring time when it can be hauled direct to the field with a minimum of labour. If the shed is situated where there is no water flow in the spring to leach away the manure and sufficient bedding is used to soak up all the liquids an excellent quality of manure will be had.

While good buildings are not necessary everything possible should be done to make the labour of feeding and attending to the cattle as light as possible. A hay rack large enough to hold a day's feed placed where it can be conveniently filled will save considerable labour. The feed troughs should be placed as near as possible to the silo or root cellar and they should be easy to clean out. Steers feeding heavily will take a lot of water and should have it before them all the time, if it can be kept from freezing. However, freshly pumped water is warmer in winter than that left standing and which has become frozen over, so rather than let cattle take the latter, it would be better to give them all they will take of freshly pumped water twice a day, after which the trough can be emptied. Where a large number is being fed with access to one tank, a tank heater can be used with profit. Such an outfit is cheap, economical of fuel, and safe.

FEEDS

In selecting feeds to be used in feeding beef cattle it is well to keep in mind that the success of the ration depends upon the palatability, variety, digestibility,

succulence and nutritive quality of the feeds included in it. All these essentials of a well balanced ration for profitable production must be included whether raising or purchasing foodstuffs.

From the farmers' and feeders' standpoints, feeds meeting the above requirements, that can be grown in Ontario and marketed economically through beef cattle, may be divided into three classes: dry roughages, succulent roughages, and grains.

DRY ROUGHAGES

Legume Hays.—Undoubtedly in Eastern Canada clover hay is the crop which can be recommended most generally. Not only is it of high nutritive value for beef cattle feeding, but it enters into practically any of the more popular crop rotations, and is a first-class soil improver. On good land, a second and third crop can often be grown. When cut at the right stage, just as it is coming well into bloom, it gives as high a tonnage per acre as any of the legume hays. It is equally suitable for young growing cattle, for stockers and for fattening cattle.

Alfalfa hay cannot be grown in all parts of Eastern Canada as successfully as red clover, and where it is grown, is usually in too great demand for dairy cattle feeding to be available for beef cattle feeding, but, where available, it is considerably more valuable than red clover. Once alfalfa is established in a suitable soil, it can be cropped two and three times a year and has this advantage over red clover that, with proper care, a good stand can be maintained for three or four years. It is particularly valuable for feeding to young animals.

Sweet clover is a comparatively new hay crop. Being a biennial, it takes the same place in the rotation as red clover. It is not, however, quite so palatable and the cattle have to be forced to it at first, but they eventually develop a taste for it. Being coarser, unless grown very thickly, it is not as valuable for feeding to young animals as is alfalfa or even good quality red clover. Its odour is against it in dairy cattle feeding but should not affect its value for beef cattle feeding.

Better and more economical gains can be made from a carbonaceous ration balanced by some of these legume hays than from a similar ration balanced by means of high-priced protein feeds such as oil cake and cotton-seed meal.

All of the above legume hays are best sown with a light nurse crop. The following rates of seeding are recommended: red clover, 10 pounds, timothy, 6 pounds, alsike, 2 pounds; or red clover, 10 pounds, timothy, 6 pounds, alsike, 2 pounds, alfalfa, 6 pounds; alfalfa alone at 20 pounds or alfalfa, 10 pounds, timothy, 6 pounds, and alsike, 2 pounds; sweet clover alone, 15-20 pounds, or as alfalfa in a mixture.

For the five years 1916 to 1920, inclusive, the average yield of hay on the Central Experimental Farm, where the red clover, timothy, alsike and alfalfa mixture is used, was 3·6 tons per acre, which was grown at an average cost of $6.40 per ton.

Timothy and other Grass Hays.—Timothy is one of the standard hay crops of Eastern Canada, and consequently is often used in beef cattle feeding. It is not, however, nearly as palatable, as nutritious, nor as economical to grow and feed to beef cattle as is red clover hay. One cutting of one and a half to two and a half tons per acre is all that can be reasonably expected, whereas a good crop of red clover will yield from three to five tons per acre. It works in well in a long rotation but the long rotation is not usually an economical one.

Hay from other grasses and native marsh or slough hay are often available. These, like timothy, are not the best of feeds, but, in certain localities, are often available at reasonable cost, and therefore it is advisable to use them up. While a certain amount will be consumed readily in the dry cured state, it is often advisable and economical, if large quantities are to be consumed, to cut some of the hay and mix it with succulent feeds, such as ensilage or pulped roots, thus making the hay more palatable and digestible.

Straw.—Straw from the various cereals, if of good quality, can be used to advantage in beef cattle feeding. When used as the sole dry roughage, it must, of course, be balanced by plenty of succulent feed such as silage or roots and by a fairly liberal proteinaceous grain ration. As with inferior hay, greater quantities will be consumed if the straw is cut and mixed with ensilage or roots so as to make it more palatable. The use of a little feeding molasses with such coarse roughages to increase their palatability is also often economical. Oat, barley and wheat straw are most valuable and in the order named.

The silo is a necessary adjunct to the steer feeding equipment on the Ontario Farm.

Annual Hay Crops.—In some instances, as where the new seeding has been killed out or where the acreage devoted to hay is not likely to be sufficient for the winter's needs, an additional tonnage of hay can be grown from some form of spring sown crop. The most popular crop for this purpose is oats, though others, such as oats and peas; oats, peas, and barley or vetch; spring rye or some of the millets may be used. Oats are a favourite because they are a crop with which the farmer is acquainted, the seed is cheap, and the yield of hay is sufficiently heavy that, when its quality is considered, it is equal to any of the others, with the possible exception of oats and peas. The oat and pea or oat, pea and barley or vetch mixture would follow in order given. These

may be classed as early to medium crops in so far as date of seeding is concerned. If sown too late in the season, the oats are liable to head out before the crop is sufficiently heavy to give a good yield of hay. If seeding is unusually late, then the millets should be used ,as they are a hot weather crop and will give a good tonnage even though sown as late as the end of June. Common millet is most generally recommended. These crops should all be cut for hay just as or shortly after they have headed out. Oats alone should be seeded at the rate of 3 bushels; oats and peas at 2 bushels and 1 bushel; oats, peas and barley or vetches at 2 bushels, $\frac{3}{4}$ bushel and $\frac{1}{4}$ bushel; spring rye at $1\frac{1}{2}$ bushels and millets at 20 to 25 pounds per acre, all on well tilled soil.

At the Central Experimental Farm, Ottawa, oat and pea hay has given, in a comparatively dry season, a yield at one cutting of 2·63 tons per acre, at a cost of $9.83 per ton. In a good season and in more humid sections, greater yields might be expected.

SUCCULENT ROUGHAGES

Ensilages.—In all localities where corn can be grown at all successfully, corn silage is undoubtedly the most satisfactory succulent roughage for the winter feeding of beef cattle. Properly grown and ensiled, it is one of the most economical crops to grow and to store, at the same time being equally as palatable and nutritious as roots and most other silage crops, besides being one of the most important crops in crop rotations from a soil improving and weed removing point of view. The average yield of corn for ensilage at the Central Experimental Farm for the ten years ending 1920 has been 15 tons per acre and the average cost stored in the silo approximately $2.85 per ton. It has been estimated that, if hay had a market value of $24.30 per ton as in 1920, corn silage was worth $7.65 per ton. With hay at $10.26 per ton, as in 1917, corn silage was worth $3.70 per ton.

In those parts of Eastern Canada where corn cannot be grown successfully, *i.e.*, not a dependable crop, there are other crops which can be used economically as silage crops. Probably chief of these, at least from a tonnage standpoint, is the sunflower. It is a comparatively new silage crop which is gaining rapid favour in the west, as it will grow where corn will not grow and yields a heavy tonnage of fairly palatable silage, though, in the latter respect, it does not equal corn silage or even good pea and oat silage. It takes the same place as corn in the rotation and is planted, cultivated and harvested in the same way, the cutting being done when the sunflowers are about 20 to 30 per cent in bloom. If left till a larger percentage is in bloom, the palatability of the silage is not so good as it is believed to be the heads which cause the rather rancid taste and odour peculiar to sunflower silage. At the Central Experimental Farm in 1921 sunflowers gave the same tonnage and cost practically the same per ton in the silo as did corn. In a feeding test with dairy cows, they gave almost equal results, though corn had the advantage in every respect. They should be equally well suited to feeding beef cattle.

Other outstanding crops for silage in place of corn are green oats or peas, oats and vetch mixture, or, in fact, a mixture of any of the cereals such as wheat, oats, rye and barley. Even the clovers, including red clover and sweet clover, and alfalfa have been used when the season was such that they could not be used as hay or pasture. They are not, however, as suitable as are the cereals. Possibly sweet clover being the least suitable for hay and yielding a heavy tonnage is best suited for silage purposes. Cut sufficiently green and well tramped into the silo, these crops, particularly the cereals, make an excellent class of silage much relished by the cattle, being more palatable than sunflower silage. In districts suited to corn or sunflowers, the cereals and legumes mentioned would hardly yield sufficiently heavy to compete with the former, but in most districts where corn and sunflowers can not be grown, the cereals or sweet clover would grow sufficiently heavy to yield an economical crop. At the Central Experimental Farm Ottawa, a crop of peas, oats and vetches sown at

the rate of 2 bushels oats, ¾ bushel peas and ¼ bushel vetches gave a yield of 6.14 tons per acre at a cost, stored in the silo, of $3.32 per ton. This silage was relished very much by the cattle but there was not enough to run a comparative test. A glance at the analysis given on the last page of this circular will show that O.P.V. silage has a higher analytical value than any other class of silage. Any cereals or legumes used for silage purposes can be grown in their regular place in the rotation. One objection is that they are not intertilled, therefore are not as useful as the cultivated silage crops in keeping down weeds, but this is partly offset by the fact that the crop is taken off early and after-harvest cultivation can be practised. They should be cut when just heading out while the stalks are still juicy, then be put into the silo immediately. Being hollow-stemmed crops, they require extra tramping in the silo to exclude the air in the stems and may even require the addition of water if natural moisture is lacking. If it so happened that crops of sunflowers, cereals or legumes were ready for the silo at the same time these crops could be mixed together as they went into the silo and as good or a better class of silage would be likely to result than if any one of these crops were put in alone.

Silos for the storage of the above crops can be put up at fairly reasonable cost in any part of Eastern Canada. Stave, cement, cement block or pit silos may be used equally successfully, the choice depending on local conditions as regards site, availability of material, etc.[1]

A point worthy of mention in connection with these ensilage crops is that, if at silo filling time a silo were not available they could all, with the exception of sunflowers, be cured into fodder. While not as good as corn ensilage, corn fodder, nevertheless, makes a fairly good rough feed. It, of course, requires more handling and there is some waste in the large stalks, unless it is run through a cutting box, which is the ideal way to feed it. The crops mentioned other than corn and sunflowers can all be made into hay.

Roots.—Where silage can be grown successfully, it is usually so much more economical to grow and store than roots that it is not advisable to grow the latter in any great quantity for beef cattle feeding unless for developing and finishing very young or baby beeves. Where other forms of succulent feed can not be grown, however, it is advisable to grow the necessary acreage of roots for a little succulent feed in the ration of beef animals is needed. Turnips (Swedes) are usually looked upon as the best class of root for fattening stock and possibly rightly so. In some cases, however, it is difficult to grow them on account of club root disease. When there is no danger of this disease, turnips will usually yield as heavily as mangels, at less cost, and will give a little greater feeding value than mangels. Where turnips can not be grown, mangels or half sugar mangels, should be grown and practically equally good results will be obtained.

Besides entailing considerably more manual labour than a silage crop, roots require storage space safe from frost, which is rather hard to secure on most farms. They are, however, valuable in the rotation and ration and use should be made of them wherever conditions warrant the same. Like the intertilled silage crops, they are valuable in the rotation in which they take the same place. If sufficient moisture is likely to be present in the soil, the roots can be sown ridged up, but usually it is safer to sow them on the flat, in rows 30 inches apart and thin them to 9 inches between plants in the row. Mangels require 5-6 pounds of seed per acre and turnips 4 pounds.[2]

GRAINS

Home-Grown Grains.—The economy of or profits to be obtained from beef cattle feeding as with any other line of live stock feeding depends upon the amount of home-

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[1] *See* Circular 102, "Silo Construction."
[2] *See* Pamphlet No. 10, "Root and Storage Cellars."

grown feeds available that can be utilized. All of the previously mentioned roughages should be home-grown and the larger the percentage of home-grown grain feeds the greater the profits that may be expected. It is true that it is often economical to purchase some concentrates, but this applies particularly to the purchase of high grade protein-rich concentrates, which can not be produced on the farm.

The greatest of all fattening grains, corn, can only be grown in limited areas in Eastern Canada and in these localities it should be made the most of. Corn has a good second, however, in barley. The acreage of barley grown in Eastern Canada has fallen off in the last year or two in spite of the fact that it is a paying crop, particularly for fattening purposes. The yield of barley in pounds per acre is higher than that of oats in each of the five eastern provinces and its feeding value for fattening purposes is fully 10 per cent higher than that of oats. It would be well for the prospective feeder to put in a good area of this crop and watch the results. Oats, the standard grain crop of the East, are better for growing than for fattening stock, but, nevertheless, can be made good use of for the latter purpose, too. Peas are not grown as a straight crop as much as formerly, consequently are not often available. They can be made use of, however, by sowing a small quantity in a mixture of other grains such as oats and barley. The resulting crop is easy to harvest and, when ground, makes an excellent feeding mixture. Care must be taken to use varieties that will ripen at approximately the same time. A good mixture would be Banner or O.A.C. No. 72 oats, 1¾ bushels; O.A.C. No. 21 barley, ¾ bushel; Arthur peas, ½ bushel.

Purchased Grain.—If the above home-grown grains must be supplemented by purchased feeds of like nature, then corn will generally be found to be the grain that will best meet the demand, market barley and oats usually being much too high in price. Another commodity which may be considered in this connection is elevator screenings. Provided the quality is good (and they should be bought on Government certificate only which is a guarantee of a minimum of weed seeds and chaff), they may be considered as being nearly equal to oats and within fifteen per cent of the value of barley. Success with this commodity depends on the quality of the screenings and the price which, in turn, is affected by the freight rates, making it almost prohibitive to the feeder in the Maritime Provinces, but worth investigating on the part of those in Ontario and Quebec.

If protein-rich concentrates are needed to balance the ration of home-grown feeds, oil cake meal or cotton-seed meal should be chosen, and the higher the percentage of protein the better the buy, provided the price is at all proportional. Where there is a lack of succulence in the ration, oil cake should be the first choice. If there is plenty of succulence in the ration, then the choice would depend on which was the cheapest per pound of protein contained when being used in the early part of the feeding period and per pound of digestible nutrients contained when being used during the finishing period.

Certain points must be kept in mind when purchasing grain feeds, and these also hold true in the case of roughages. The residue of these feeds in the manure have a high value if the latter is well handled; the manurial value of feeds varies considerably; and that the manurial residue from the feeds is higher in the case of animals near the finishing point than with those that are just going into the feed lot. For instance the residue manure value, per ton, of corn figuring the fertilizing elements at nominal prices is only $3.78, while that of oilcake meal is $12.10, that of cotton-seed meal is $15.87, that of alfalfa hay is $6.40, that of clover hay is $5.23, while that of timothy hay is only $3.05.

The following table gives the total dry matter as well as the total digestible protein, carbohydrates and fat of the various feeds mentioned. The fifth column of the table gives the total digestible nutrients in one ton of each feed. These figures are, within certain limits, an indication of the relative value of the respective feeds. The column to the extreme right of the table gives the approximate manure value of the residue of each feed, provided the manure is well handled.

DIGESTIBLE NUTRIENTS IN FEEDS MENTIONED

Dry Roughages

Feed	Total Dry Matter per 100 lb.	Digestible Nutrients in 100 lbs.			Total Digestible Nutrients in 1 ton	Approx. Manure Value per ton
		Protein	Carbohydrates	Fat		
	lbs.	lbs.	lbs.	lbs.	lbs.	$ cts.
Clover hay	87·1	7·6	39·3	1·8	1,018	5 23
Alfalfa hay	91·4	10·6	39·0	0·9	1,032	6 40
Sweet clover hay	91·4	10·9	38·2	0·7	1,014	4 32
Clover and mixed grass hay	89·9	4·7	39·9	1·3	950	4 40
Timothy	88·4	3·0	42·8	1·2	970	3 05
Orchard Grass	88·4	4·7	41·1	1·6	988	3 63
Swamp grass	90·2	3·5	40·1	0·8	908	1 84
Mixed grasses	87·2	4·3	44·3	1·2	1,026	3 46
Straw (oat)	88·5	1·0	42·6	0·9	912	2 27
Straw (barley)	85·8	0·9	40·2	0·6	850	1 96
Straw (wheat)	91·6	0·7	35·1	0·5	738	1 46
Oat hay	88·0	4·5	38·1	1·7	928	5 31
Peas and oat hay	83·4	8·3	37·1	1·5	976	4 58
Peas, oats and barley	83·5	9·2	36·9	1·8	1,002	....
Rye hay (early bloom)	91·8	6·4	46·0	1·1	1,098	3 38
Millet hay (common)	85·7	5·0	46·0	1·8	1,100	4 04
Fodder corn	81·7	3·0	47·3	1·5	1,074	2 59
Succulent Roughages						
Corn silage (C.E.F.)	23·83	0·98	12·29	2·11	360	1 07
Sunflower silage (C.E.F.)	25·62	0·99	13·03	1·31	339	....
Peas and oat silage (C.E.F.)	29·97	3·05	13·80	1·28	395	1 62
Clover silage	27·80	1·30	9·50	0·50	238	....
Alfalfa silage	24·60	1·2	7·80	0·6	208	....
Sweet Clover silage (C.E.F.)	24·92	1·61	8·04	0·24	203·8	....
Mangels	9·40	0·8	6·4	0·1	148	0 59
Turnips (swedes)	10·9	1·0	7·7	0·3	188	0 59
Dried Beet pulp	93·6	4·6	65·2	0·8	1,432	1 52
Grains						
Dent corn	89·5	7·5	67·8	4·6	1,714	3 78
Barley	90·7	9·0	66·8	1·6	1,588	4 56
Oats	90·8	9·7	52·1	3·8	1,408	4 53
Peas	90·8	19·0	55·8	0·6	1,524	6 85
Screenings (C.E.F.)	88·62	10·2	44·94	5·03	1,329	4 10
Oil cake meal	90·4	31·7	37·9	2·8	1,518	12 10
Cotton seed meal, choice	92·5	37·0	21·8	8·6	1,564	15 87
Gluten feed	91·3	21·6	51·9	3·2	1,614	7 99
Gluten meal	90·9	30·2	43·9	4·4	1,680	8 96

RATIONS

The progressive steps in growing a beef steer are first to develop by continuous growth, a large frame well covered with muscle and never entirely denuded of fat; then to deposit on this frame the fat necessary to give the animal the desired finish. To achieve the first step, requires a ration rich in bone and muscle building feeds such as whole milk, skim-milk, roots, ensilages, legume hays and grains such as bran, oats and oil cake meal. To achieve the second step, requires a somewhat similar ration, at first, but this must be gradually changed to one containing a large proportion of the fat producing carbonaceous foods such as corn, barley or peas.

As this publication is concerned chiefly with the finishing process only rations suitable for finishing will be discussed. The following are examples of daily rations for 1,000-pound steers:—

A.	Lbs.
Hay (preferably clover)	8–10
Silage	35–45
Grain Mixture No. 1	1– 8

B.	
Hay (preferably clover)	4– 5
Hay (oat and peas)	4– 5
Silage	35–45
Grain Mixture No. 1	1– 8

C.	
Hay (preferably clover)	6– 8
Straw (oat or barley)	4– 5
Silage	25–30
Roots	25–30
Grain Mixture No. 2	1– 8

D.	
Hay (preferably clover)	10–12
Roots	50–60
Grain Mixture No. 2	1– 8

E	
Hay (preferably alfalfa or clover)	12–20
Dried beet pulp (soaked before feeding)	3– 5 dry weight
Grain Mixture No. 3	1–12

GRAIN MIXTURES

In making a grain mixture the feeds at hand and possible to purchase must be kept in mind as also the economy of the latter figured on nutritive and manurial value, as per table given. The following mixtures allow for selection according to circumstances:—

No. 1.—Bran, 1 part; oats, 1 part; barley or corn, 2 parts; oilcake or cottonseed meal, 1 part. Increase corn or barley towards finish.

No. 2.—Bran, 1 part; barley or peas, 1 part, or oats, 2 parts; corn, 2 parts; oilcake or cottonseed meal, 2 parts.

No. 3.—Bran, 1 part; oats, 2 parts; barley, 1 part; corn, 1 part; oilcake meal, 2 parts.

Replacements of grain, other than those indicated, might be, gluten meal in place of oilcake or cottonseed meal; good quality of recleaned elevator screenings, in place of oats or barley; extra oats or screenings in place of bran; and gluten feed in place of corn. Of the two highly proteid feeds, oil cake and cottonseed meal, the former is to be preferred when there is limited succulence in the ration.

In recommending feeding the grain mixture at from 1 to 8 pounds or more per day, according to the ration used, it is to be understood that the steers receive 1 pound per day, at the start, and up to eight pounds at, or near, the finish. The usual rate of increase is 1 pound per week. The grain ration may be started at once, or delayed a few weeks, according to the condition of the steers. This point comes up for discussion later on in this publication.

Dried beet pulp is included in ration E where no other succulent feeds appeared. Provided that the beet pulp can be bought reasonably, it makes a good substitute for home-grown succulent feeds in the ration. It should always be soaked before feeding, and will be more palatable if soaked with hot water. A little molasses in the water used would increase the palatibility and feeding value materially.

The steers should have a supply of salt regularly. The amount given must be left to a certain extent to the judgment of the feeder, but about one handful, per day, per steer, is recommended. Rock salt may be used to advantage, the steer taking what his system demands. As previously mentioned water should be supplied freely.

Coarse dry roughages, such as poorly cured hay, may be made more digestible and palatable by cutting them up and mixing them with silage or pulped roots. This process, however, adds considerably to the cost of feeding and is only to be recommended where there is a quantity of such roughages to be used up, such as would otherwise be wasted. As regards pulping roots, it will usually be found that the steers will eat them whole, particularly if they are fed in a manger where the animal can corner them up. It may possibly prove profitable, however, to pulp the roots towards the end of the finishing period as the steers, having less keen appetites, will eat more of the roots pulped than might be the case if they had to work for them.

Another method of getting more coarse, dry roughage consumed is to treat it with feeding molasses. This may be done by mixing up a fairly strong mixture of molasses and water and pouring it over the long material, after it is placed in the manger, or the material may be cut up and moistened with molasses and water. Molasses is frequently too high in price to be used as a regular feed but small quantities of it, used in this way, will acquire quite a high value.

LIGHT VS. HEAVY GRAIN FEEDING

As already emphasized the greater part of the gains in steer feeding must come from the consumption of cheap home-grown roughages, if any reasonable profit is to ensue. One question that may be asked is: How much grain can profitably be fed? The following table shows the results of one test in which two lots were fed—one a light and the other a heavy grain ration. Lot 1 received no grain for first month and half and then received grain at the rate of 2 pounds per steer, per day, increasing this amount 1 pound per steer, per day, each week until 10 pounds daily was being given. Lot 2 received 2 pounds per steer, at the start, increasing this amount 2 pounds per steer, per day, each week, until 10 pounds daily was being given. In other words Lot 1 was on full grain ration before lot 2 received any grain ration.

TABLE VIII.—LIGHT vs. HEAVY GRAIN FEEDING

—		Lot I Shed	Lot II Shed
		Light Grain	Heavy Grain
Number of steers in lot		23	24
First weight, gross Nov. 21, 1918	lbs.	18,590	19,940
First weight average	"	808·2	830·8
Finished weight gross Mar. 31, 1919	"	22,970	25,220
Finished weight average	"	998·6	1,050·8
Total gain in 130 days	"	4,380	5,280
Average weight per steer per day	"	1·46	1·69
Total hay consumed at $7 per ton	"	18,720	18,720
Total ensilage consumed at $2 per ton	"	144,960	144,960
Total meal consumed at $47.40 per ton	"	10,304	22,992
Total cost of feed	$	255 72	755 43
Total cost of feed per steer	$	19 81	31 47
First cost of steers	$	2,197 87	2,349 43
Total cost	$	2,653 59	3,104 86
Receipt from sale	$	3,085 91	3,384 19
Profit per lot	$	432 32	279 33
Profit per steer	$	18 79	11 63
Average feed cost per lb. gain	cts.	10·40	14·30
Meal consumed per lb. gain	lbs.	2·3	4·3
Hay consumed per lb. gain	"	4·2	3·5
Silage consumed per lb. gain	"	32·4	27·4

The steers used in this experiment would be classed as thin feeders, being in a little too high condition for the stocker class. The results obtained go to show that it is not profitable to rush grain feed to such a class of steer until he has made some

preliminary gains on roughages. This of course applies to thin feeders particularly and would not hold good in the case of short keep steers.

FEEDING SHORT AND LONG KEEP STEERS

From the preceding discussion, the difference in feeding methods to be followed with short and long keep animals has been made fairly obvious. It has been shown that the short keep animal to be profitable must be fairly well matured and also be in fairly good flesh and general condition—ready to put on the finish rapidly. The ration for such an animal should consist of a moderate amount of roughage of good quality, supplemented by a grain mixture relatively rich in the fattening grains such as barley and corn. A mixture of equal parts of bran, oats, barley, and corn should be highly desirable at the start with the addition of some oilcake meal during the last few weeks. The grain mixture should be started at the rate of two or three pounds per day and increased gradually, but as rapidly as possible, to the full feed of from eight to twelve pounds per head daily. As the grain ration increases, and particularly towards the end of the feeding period, the roughage ration should be reduced slightly, especially the more succulent part of it, such as the silage or roots. It is, however, important at this time to maintain or even improve the quality of the dry roughage that is fed.

In the case of the long keep animals their thinner condition at the start makes a different method of feeding advisable. The animal's body must be built up by the development of muscle before fat will be laid on to any great extent. Feeding a ration rich in muscle forming constituents, or in other words proteids, would be indicated necessary at the start. If a surplus of carbohydrates or fat forming foods is fed before the animal is in a condition to assimilate and make use of them, they will be wasted and may even be detrimental to the best development of the animal. The protein may be supplied in the roughage part of the ration in the form of clover hay or peas and oats hay. Considerable quantities of silage and roots may also be given to this class of steers at the start, letting them make their initial gains on cheap feeds. In fact, if the roughage is of good quality and it is intended to carry the steers for a fairly long feeding period, no grain need be given for the first four to six weeks. The grain ration for the first period may consist of bran and oats in equal parts with the addition of ten per cent of oilcake or cottonseed meal. Start at one pound per animal per day and gradually increase the amount. After eight to ten weeks of grain feeding, gradually change the grain ration, by introducing more of the fattening foods, such as barley and corn, until they make up one-half to two-thirds of the ration. At the same time, keep increasing the amount fed until the animals are getting eight to twelve pounds daily. As in feeding the short keep animals, the roughage ration, particularly the succulent part of it, must be cut down towards the end of the feeding period or the animals will not have an appetite for the full grain ration. During the last few weeks of the feeding period it may even be necessary to feed additional oilcake in the grain ration to get the animals to eat it up clean.

METHODS OF FEEDING

The method of feeding is important as it may affect the gains made as well as the amount of labour necessary. The usual custom followed by experienced feeders is to divide the daily ration, giving one half in the morning and the other half in the evening. The procedure followed at the Central Experimental Farm is to feed ensilage or roots with the grain on top first thing in morning, followed later by hay. A separate feed rack for hay being provided, both feeds can be given at once and enough hay put in the racks for one day. The other feed of ensilage and meal is given in late afternoon. Where no separate rack for hay is provided, the second feed of hay is given as soon as the last feed of ensilage is cleaned up. This procedure has two

advantages: first, all daily routine work in connection with the steers can be done in morning and evening, leaving the mid-day period free for other work; second, the steers, are filled up early and have the remainder of the day to rest and assimilate their feed without being disturbed. Feeding three times a day does not give them the same chance in this respect.

PREPARING STEERS FOR SHIPMENT

The purpose of reducing the succulent part of the ration towards the last of the finishing period is to harden up the flesh with the idea of preventing shrink in transit. This can be further aided by cutting out the succulent feed entirely just before shipment and allowing the animals to fill up on dry hay, grass hay being preferable to clover in this case. The grain ration may be maintained to the last provided it is not of too laxative a nature. Cutting out the salt, just previous to shipment, will also help, the dry hay being sufficient to cause the animals to drink plenty of water.

The appearance of the animals counts considerably when selling, both in the feed lot and on the market. They should be clean and trim as it is possible to have them. Grading them in uniform lots, as to size and finish, will also help greatly in realizing a higher price.

EXPORT STEERS

With the embargo still effective and preventing the entry of feeding cattle to Great Britain, the main requirements of the export steer are size, quality and finish. Size is important because, in shipping by water, the charge is per animal and not by weight; consequently a heavy steer can be shipped to the best advantage. Quality and finish are required because the trade calls for it. Great Britain is noted for the quality of beef produced; consequently if it is hoped to compete in that market, the quality demanded must be forthcoming. Furthermore, the finish must be recently acquired and not of some standing, the latter condition making for tough beef. An example would be the case of show animals kept in high fit for some time and then exported.

Should the embargo be lifted and feeding steers allowed entry to the Mother Country, the demand will still be for a fairly large, typey steer with a fair degree of fleshing and evidence of breeding. Such a steer is a good prospect for a quick finish, and only such a beast will be welcomed by the cattlemen overseas.